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THE MANUFACTURE OF LOW-ACID RENNET-TYPE COTTAGE CHEESE

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INTRODUCTION

Cottage cheese is a valuable food product, and when it is properly made it is highly esteemed by the consuming public. The character and the quality of the finished product depend very largely upon the methods used in manufacture. The low-acid rennet type of cottage cheese has been made by a number of creameries, dairies, and milk-products plants, but with various degrees of success. The low-acid rennet type is a superior and profitable product when properly made. In order to determine the best method for making a uniformly high-grade cottage cheese of this type, the Bureau of Dairy Industry has, by experimental work conducted in the laboratory and on a commercial scale, demonstrated a method which has consistently produced excellent results. This method is now in operation in the commercial creamery at Grove City, Pa., where the bureau maintains laboratories under a cooperative arrangement with the creamery. By using this method more dairy-products plants could improve the quality of their cottage cheese and thus more profitably utilize their skim milk. The method is described in this publication.

When properly made, this type of cottage cheese is characterized by a low acid content, high keeping qualities, and distinctive curd particles which retain their shape after milk and cream are added, and give a more attractive appearance to the finished product. The cubes of curd are firm enough to retain their original shape to a large extent, but the curd is not hard or tough. Many of the dairy plants that are making this type of cottage cheese have been able to build

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up a greater demand for it than for the older types of cottage cheese. In many cases the price received has been higher, and a greater profit has been realized.

Cottage cheese is a perishable product. It should be made often, and properly taken care of, so that it will always be fresh when it reaches the consumer. It is made in such a way that the curd before the addition of milk and cream is dry and low in acid, and will keep for several days if held in storage at a temperature of 30° to 40° F. The dry curd should always be held at this temperature for about 12 hours before the mixture of milk and cream is added. During this time the curd firms up and will then stand vigorous mixing without breaking up or becoming granular. Since the dry curd has better keeping qualities than the enriched curd, only a day's supply should be mixed at a time. The relatively large proportion of milk and cream which is added to the dry curd makes it necessary to always keep the enriched curd in a cool place to prevent souring and separation of whey.

QUALITY OF SKIM MILK REQUIRED

The quality of the cheese depends largely on the quality of the skim milk from which it was made. Therefore, it is important that sweet, clean, skim milk, free from undesirable odors and flavors, be used. The skim milk should be pasteurized at 145° F. and held at this temperature for 30 minutes. Oftentimes the milk is pasteurized in the afternoon and set the following morning. If the pasteurized skim milk is to be held overnight or for several hours before setting, it should be cooled to about 40° and held at that temperature until just before the starter and rennet are added.

EQUIPMENT REQUIRED

In making any product it is always desirable to have proper and adequate equipment. The following equipment, some of which may already be in the creamery or milk plant, is required. This equipment, with the exception of a whey tube and mechanical mixer, may be obtained from any of the diary supply companies.

Pasteurizer.
Cheese vat.
½-inch curd knives.
Whey tube.
Strainer pail.
Acidity test.
Curd pail.
Wooden paddle.
Vat whey strainer.
1 c. c. pipette graduated in tenths.
10 c. c. pipette graduated to 1 c. c.
100 c. c. volumetric flask.
Mechanical mixer.
Straight-side cans or butter tubs for holding curd.

An ordinary cheese vat with a water jacket should be used, because a slower and more uniform cook will result than with a steam-jacketed vat.

Regular ½-inch horizontal and perpendicular Cheddar cheese curd knives are used to cut the curd into ½-inch cubes.

The whey tube (fig. 1) is a very convenient piece of equipment that can be used to obtain a representative sample of whey when making any type of cheese where the acidity of the whey at cutting is important. It is sometimes difficult to get a representative sample

of whey when making this type of cottage cheese if the whey tube is not used. The whey tube is set on the curd, and when it sinks down to the flange the curd is dipped out of the cylinder with a spoon. Within a few minutes whey from underneath the surface of the curd will take its place. In the winter months when the temperature of the room usually drops during the night, the whey obtained from underneath the surface of the curd will have a higher temperature and will therefore usually show a higher acidity than whey taken from the surface.

The 10 c. c. pipette and 100 c. c. volumetric flask are used in measuring the amount of rennet.

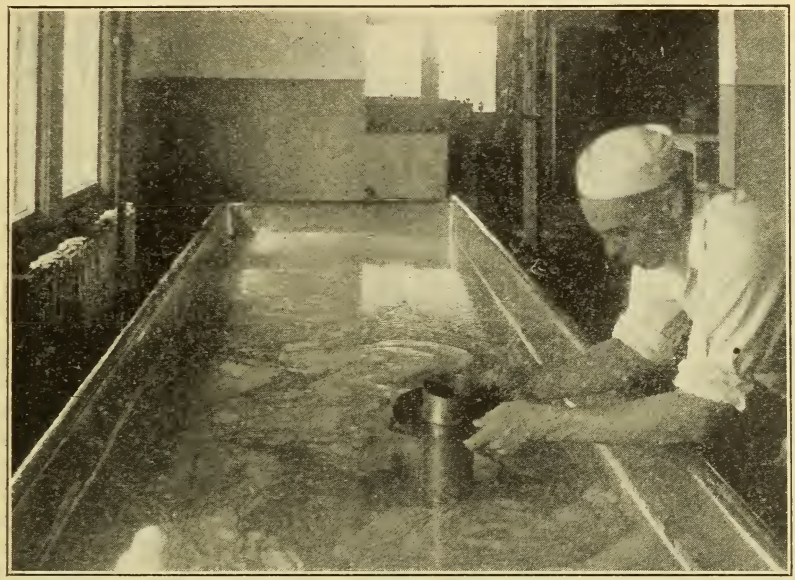

FIGURE 1.—Whey tube used in obtaining a sample of whey

The mechanical mixer (which is sometimes called a cake or dough mixer) is used when salting and mixing the curd. (Fig. 2.)

The cans for storing the dry curd should be of the straight-side type, to facilitate removal of the curd for salting and creaming; a can of this type is shown in Figure 2.

SETTING THE SKIM MILK

The setting temperature depends somewhat upon the temperature of the room, but is usually from 72° to 80° F. Add from 1 to 5 per cent of good starter, depending upon the quality of the starter and the length of time most desirable from setting to cutting. It is very important that a good active lactic starter, free from gas and uniform from day to day be used in making this type of cheese. To each 1,000 pounds of skim milk add ¾ to 1¼ c. c. of rennet. Usually 1 c. c. of rennet per 1,000 pounds of skim milk is required. When less than 1,000 pounds of skim milk is to be processed the amount of rennet required can be measured accurately by proper use of the

pipettes and volumetric flask. For example, 555 pounds of skim milk would require 0.55 c. c. rennet. To obtain this amount measure 10 c. c. of rennet by means of the 10 c. c. pipette into the 100 c. c. volumetric flask, and fill the flask with cold water to the 100 c. c. mark. Then for each tenth of a cubic centimeter of rennet required measure out 1 c. c. of the diluted rennet and add it to the skim milk with stirring after it has been further diluted to make the final concentration 1 part of rennet to 40 parts of cold water. The rennet should always be diluted at the rate of 1 part rennet to about 40 parts of cold water before it is added to the skim milk. The character of the curd is more easily controlled by varying the setting temperature and the amount of starter than by varying the amount of rennet. When allowed to set about nine hours at a temperature of 74° F. the addition of 1 per cent of starter and 1 c. c. of rennet per 1,000 pounds of skim milk is usually sufficient to develop the character of the curd desired. To get the best results, 5 to 10 hours should be allowed from setting to cutting.

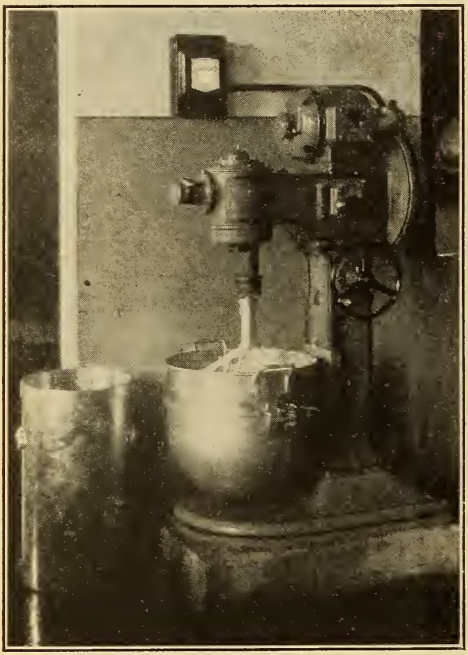

FIGURE 2.—A mechanical mixer and a straight-side can

CUTTING THE CURD

The curd at cutting should be firm but not hard or brittle. It should break clean in front of the finger and be only very slightly wheyed off, if any. The acidity of the whey at cutting should not be much less than 0.50 per cent or much more than 0.55 per cent. A slight break in the curd will usually expel sufficient whey for the acidity test, but with the whey tube a more representative sample can be obtained. When the curd is in the condition above described it is ready to cut and cook. While cutting the curd fill the water jacket with water at a temperature of 105° to 115° F. The curd should be cut lengthwise with the ½-inch horizontal knife, and lengthwise and crosswise with the ½-inch perpendicular knife.

COOKING THE CURD

Great care should be taken in cooking the curd. It is very important that this be done slowly and uniformly. The final cooking temperature will sometimes vary from 118° to 130° F., depending upon the acidity of the whey and the character of the curd. The quantity of skim milk in the vat is also a factor because it takes

longer to remove the whey and cool the curd when a large quantity of skim milk is being processed than it does when a small quantity is being handled. Therefore, a lower cooking temperature can be used when a large quantity of skim milk is being processed. If the curd is too hard or brittle and the whey has a high acidity when the curd is cut, it will be difficult to get a firm dry cheese even by cooking to an abnormally high temperature. If the curd is soft and the whey has an acidity of less than 0.45 per cent when the curd is cut, the cheese will be tough and undesirable, regardless of the cooking temperature. A temperature of 118° to 130° will usually be high enough to firm a curd that has a firm coagulation, and an acidity of 0.50 to 0.55 per cent in the whey at cutting.

FIGURE 3.—Stirring the curd while cooking

The cooking should be done slowly. It should take 1 to 3 hours to raise the temperature from that at cutting to the desired cooking temperature, depending upon the character of the curd and the acidity of the whey.

Immediately after cutting the curd, cover it with 2 inches of water at 105° to 115° F., and keep the temperature of the water in the jacket 25° to 35° higher than the temperature of the curd. Stir the curd very carefully, and just enough to insure an even cook.

A hard, brittle curd will break up more easily than a softer coagulation. Do not stir a hard, brittle curd until the temperature has been raised to about 100° F., and then stir very carefully. In order that the cheese will have the characteristic appearance of this particular type, do not stir the curd until this can be done without breaking it and causing the whey to become cloudy. The temperature will rise slowly and the curd will firm up considerably if the water in the water jacket is kept 25° to 35° warmer than the curd. About one-

half hour after the 2 inches of water at 105° to 115° has been placed on top of the curd, run a slow stream of water at about 120° through the curd with a hose. This will take the place of stirring and will not break the curd.

As an indication of when the curd is sufficiently cooked, it will stand a light pressure between the hands and hold its shape; or, a handful of curd placed in a dipper of cold water will feel firm and solid and the curd will hold its shape. In either case, the cheese is now ready to be drained and washed.

WASHING AND DRAINING THE CURD

As soon as the curd is of the desired firmness draw off the whey and wash the curd with cold water. The colder the wash water the better, for the sooner the curd is chilled the less it will break up, and further acid development will be retarded. The number of washings required depends upon the acidity of the curd; the more acid the curd is, the more it should be washed. Two or three washings are usually enough. Place the cold-water hose in one end of the vat and let the water work its way through the curd. To avoid breaking the curd, do not stir it until it is completely covered with water. When the curd is sufficiently washed, then drain, ditch, or trench it and let it stand in the vat for about one hour so it will drain thoroughly.

CHILLING THE CURD

After the curd has been washed and drained in the vat, it must be thoroughly chilled by storing for about 12 hours at a temperature of 30° to 40° F. Proper chilling is essential, in order that the curd may cream satisfactorily without excessive breaking. The curd should also be handled carefully when removing it from the vat to avoid breaking.

Probably the most satisfactory method of storing and chilling the curd is to pack it in either straight-side cans or ordinary butter tubs. There will be some additional draining during the chilling period and this can be facilitated by inverting the cans or by using tubs with holes bored in the bottom and sides. The curd is sometimes placed on special trays and held in the cooler, or it is put into sacks and stacked in the vat two or three sacks high, with cracked ice between the layers to bring about more rapid chilling. However, cans or tubs are most commonly used. If the curd is kept in a storage room for about 12 hours at a temperature of 30° to 40° F. it will be in the desired condition to mix with milk or cream without difficulty.

The general appearance of the curd after chilling is shown in Figure 4. Figure 5 shows an acid, nonrennet type of curd.

SALTING, ENRICHING, AND MIXING THE CURD

The character of this type of curd is such that it will absorb relatively large amounts of cream, milk, or skim milk, yet the curd is firm but tender and will retain its shape well after mixing. During the mixing process, 100 pounds of dry curd will readily take up 60 to 75 pounds of a mixture of milk and cream containing 10 per cent fat. This may seem to be an excessive amount of cream and milk

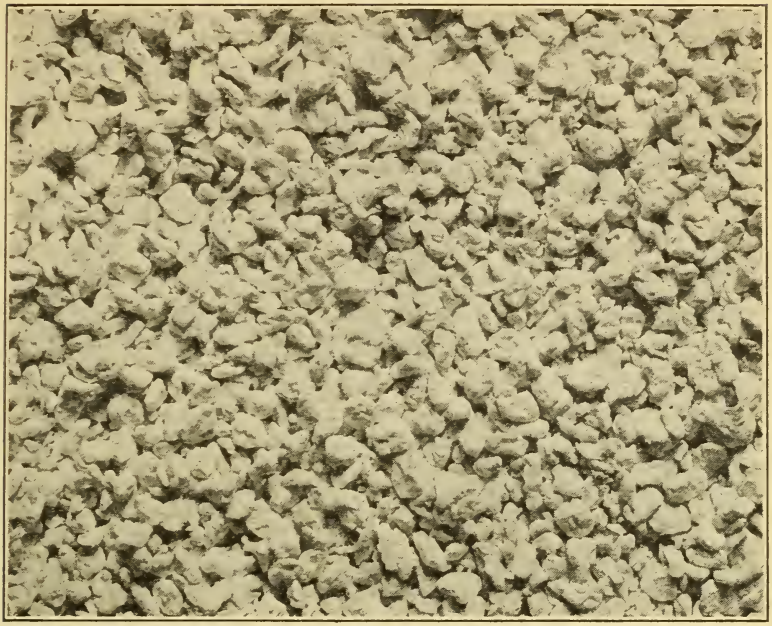

FIGURE 4.—The low-acid rennet type of curd, after chilling. (Actual size)

FIGURE 5.—Acid nonrennet type of curd. (Actual size)

mixture to use and very unprofitable. However, when calculated on the weight basis, it can be readily shown that the use of such amounts of cream and milk in cottage cheese can be highly profitable. For example, if cottage cheese to which a cream and milk mixture containing 10 per cent butterfat has been added is selling at 7 cents per pound, then every pound of this mixture containing 0.1 of a pound of butterfat will, when added to the curd, bring 7 cents. This amounts to 70 cents per pound of butterfat.

Some manufacturers sell both plain and enriched cottage cheese. When the cheese is sold plain the price differential is usually 2 to 3 cents per pound. If the price of creamed or enriched cottage cheese was 7 cents and uncreamed or dry cottage cheese was 4½ cents per pound, and 70 pounds of a mixture of cream and milk containing 10 per cent butterfat were added to 100 pounds of dry curd, the increase in yield and the additional price received for the enriched cheese would amount to $1.05 per pound of butterfat, or $10.57 per 100 pounds of the 10 per cent cream and milk mixture. Therefore, it is usually more profitable for the manufacturer to enrich and mix his cottage cheese than to sell it dry.

When any considerable volume of curd is handled, it is necessary to have some type of mechanical mixer, for when a cream and milk mixture is placed on this type of curd and is not vigorously mixed with the curd, the mixture does not become thick and viscous. Larger lots of curd can be handled more quickly, and the results from day to day will be more uniform when a mechanical mixer equipped with a flat-type beater is used than when mixed by hand; also, the combined beating and stirring action of the mechanical mixer plays an important part in producing the characteristic body and texture desired in this type of cottage cheese. The mixing process tends to thicken the cream and milk without any appreciable breaking up of the curd. It is probable, however, that sufficient curd is emulsified with the cream and milk mixture to produce the thick viscous condition which enables this type of cheese to retain its characteristic creamy appearance.

For mixing, place the curd in an ordinary 60 to 80 quart cake mixer. Add 1 pound of salt and 60 to 75 pounds of a mixture of cream and milk containing 10 per cent butterfat to each 100 pounds of dry curd. It is advisable to homogenize the cream and milk mixture at a pressure of 2,500 pounds per square inch and a temperature of about 115° F. The homogenized product should be cooled before it is added to the curd. The mixer should be run in low gear for about five minutes, and the enriched cheese should then be placed in the cooler to set up. Small batches of curd may be mixed by hand, but hand mixing requires vigorous stirring for a longer period in order to produce the same character of enriched cheese as that obtained with the mechanical mixer. Immediately after adding the cream and milk mixture to the curd and mixing, the cheese will appear to contain too much of this cream and milk mixture, but after it has been held in storage for a few hours the curd will have absorbed this apparently excess mixture, and the cheese will have a characteristic creamy appearance. This type of cottage cheese will retain its creamy appearance for a longer period than the other types. This is very desirable.

As this type of curd is firmer and drier than that in most cottage cheese, only 12 to 15 pounds of dry curd is obtained from 100 pounds of skim milk. The cost of manufacturing is about the same as for any properly made cottage cheese.

MARKETING

When this type of enriched cottage cheese is properly made it has a characteristic rich, creamy appearance and a distinctive curd, which make it very attractive to the consumer.

The enriched cheese may be packed in 12-ounce or 16-ounce containers. The distinctive characteristics of this type of cheese are displayed to much better advantage by using an open jar or tray displayed in a refrigerated show case. When the cheese is to be sold in small containers, the manufacturer may supply his dealers or retailers with a suitable package on which may be printed his name, and if desired, a trade name. To prevent misuse of containers a definite number could be furnished with each delivery of 50 or 100 pounds of cheese. As a further means of building up sales, the retailer's name and address could also be printed on the container, or suitable space could be provided for an attractive and descriptive label.

In many cases delivery trucks serving regular routes and customers, both wholesale and retail, have been established. In order that the consumer may be assured of always receiving cheese of the highest quality, it is important that the dealer should be supplied by the manufacturer with fresh cheese at regular intervals. A high-grade product put up in an attractive package under a distinctive trade name, and delivered promptly and frequently, will play an important part in the successful marketing of this type of cottage cheese.

BRIEF DIRECTIONS

Pasteurize the skim milk at 145° F. and hold 30 minutes.

Maintain the setting temperature, 72° to 80° F., throughout the fermentation period of 5 to 10 hours.

Add from 1 to 5 per cent of good starter.

Add 1 c. c. of rennet per 1,000 pounds of skim milk.

Acidity of the whey at time of cutting the curd should be 0.50 to 0.55 per cent. The curd should be firm, but not hard or brittle.

Fill the jacket of the vat with water at 105° to 115° F.

Cut the curd into ½-inch cubes.

Run 2 inches of water at 105° to 115° F. over the cut curd and repeat in one-half hour with water at 120°.

Stir the curd carefully until it will stand stirring without breaking.

Keep the water in the jacket 25° to 35° warmer than the curd.

Cook the curd slowly to a temperature of 118° to 130° F. in 1 to 3 hours. Small batches should be cooked to a slightly higher final temperature.

When the curd can be gently squeezed in the hand and will hold its original shape, draw off the whey.

Wash the curd two or three times in cold water, depending upon the acidity of the curd.

After the curd has been washed, ditch it, allow it to drain for one hour, and put it on trays, or in cans or in tubs with holes in the bottom, and place in a cooler at 30° to 40° F. for about 12 hours.

Add 1 pound of salt per 100 pounds of dry curd at time of mixing.

At the end of about 12 hours the curd will be firm and dry. To each 100 pounds of curd add 60 to 75 pounds of a mixture of milk and cream containing 10 per cent butterfat. Then stir the mixture vigorously by hand, or for five minutes in a mechanical mixer operated in low gear. Then put the cottage cheese in a cooler for a few hours at from 30° to 40° F. It is then ready to package.

The curd should be firm, and even after it is mixed the curd particles should be distinct; however, the curd should not be tough or hard a few hours after mixing. Careful cooking is necessary to get the proper degree of firmness.

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